Synthesis of Spiroheterocycles Related to Spiro[flurен-9,2'-(1',3'-oxathiolan)]-5'-one and Spiro[anthracen-9(10H),-2'-(1',3'-oxathiolan)]-5'-one

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SUMMARY

Interaction of thioglycolic acid with flourenoue Ia and/or anthrone Ib afforded spiro[flourene-9,2`-(1`,3`-oxathiolan)]-5`-one (2a) and spiro[anthracene-9(10H), 2`-(1`,3`-oxathiolan)]-5`-one (2b) respectively. Subsequent molecular condensation of 2a,b with primary (alkyl, aryl and heterocyclic)amines, hydroxylamin hydrochloride and hydrzines gave the corresponding spiro thiazolidine and spirothiadiazinone derivatives 3a,b-6a,b respectively.

INTRODUCTION

Spiro derivatives exhibit intersting photochromic properties, biological activity and optical activity[1-6]. Furthermore several thiazolidinones have gained commercial importance as drugs (e.g. bactericidal, fungicidal, pesticidal, insecticidal, anticonvulsant, tuberculostatic, antiinflammatory, antithyroidal and potentiation of pentobarbital-induced sleeping time)[7-10]. We report here in a facile routes to spiroheterocycles related to thiazolidin-4-ones incorporated with flourene and anthracene moieties.

RESULTS AND DESCUSSION

Reaction of thioglycolic acid with flourenone (Ia) and/or anthrone (Ib) afforded spiro[flourene-9,2`-(1`,3`-oxathiolan)]-5`-one (IIa) and/or spiro[anthrancene-9(10H), 2`-(1`,3`-oxathiolan)]-5`-one (IIb). The reaction of compounds IIa and/or IIb with primary alkyl, arylamine and heterocyclic amines in absolute ethanol proceeds very smooth at room temp. or at reflux temp. giving spiro[flourene-9,2`-thiazolidin]-3`-(aryl or heterocyclo)-4`-one (IIIa-c) and spiro[anthracene-9(10H)-2`-thiazolidin]-3`-(aryl or heterocyclo)-4`-one (IVa-e) respectively (cf. Scheme 1).

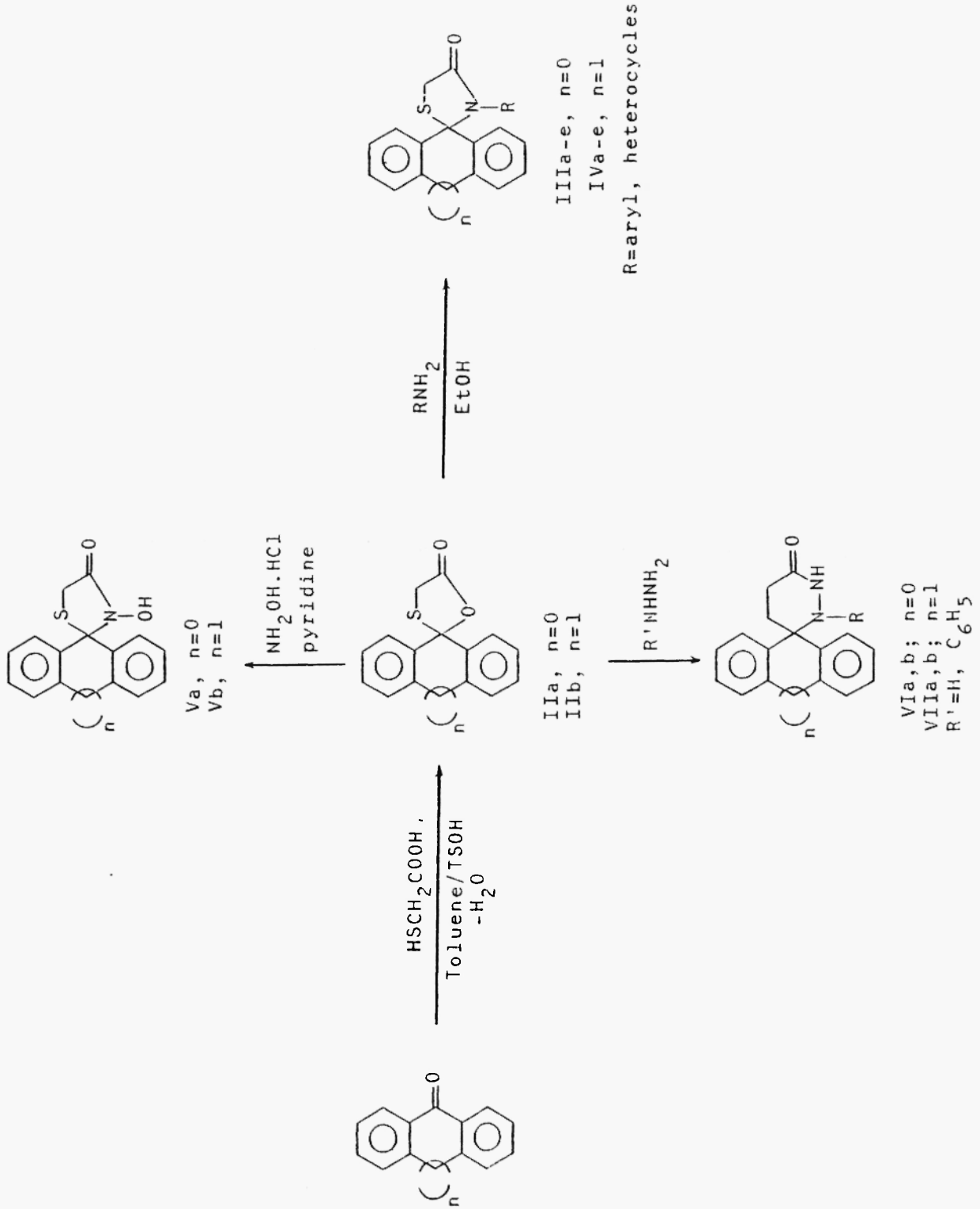
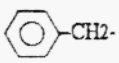
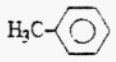
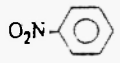

HSCH2COOH,
Toluene/TSOH
-H2O
IIa, n=0
IIb, n=1
NH2OH.HCl
pyridine
Va, n=0
Vb, n=1
R'NHNH2
VIa,b; n=0
VIIa,b; n=1
R'=H, C6H5
RNH2
EtOH
IIIa-e, n=0
IVa-e, n=1
R=aryl, heterocycles

Table 1: Physical data of the synthesised spiro derivatives 2a,b - 7a,b

Comp. no.	R or R'	m.p °C	Yield %	Molecular formula* (M.W) / solvent)	IR (KBr) cm^{-1}	^1H-NMR (Solvent) δ (TMS) ppm
IIa	-	192-194	80	$C_{16}H_{10}O_2S$ (254.3) (ethanol)	3030 (CH arom), 2850 (CH aliph), 1700 (C=O), 700 (C-S)	(DMSO-d_6): 3.70 (2H,s), 7.10-8.00 (8H,m).
IIb	-	220-222	80	$C_{16}H_{12}O_2S$ (268.3) (ethanol)	3050 (CH arom), 2920 (CH aliph), 1700 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 4.20 (2H,s), 7.20-8.10 (8H,m).
IIIa		138-140	75	$C_{21}H_{15}NOS$ (329.4) (ethanol)	3060 (CH arom), 2980 (CH aliph), 1675 (C=O), 700 (C-S).	(DMSO-d_6): 3.70 (2H,s), 7.00-8.10 (13H,m).
IIIb		160-162	80	$C_{22}H_{17}NOS$ (343.5) (ethanol)	3040 (CH arom), 2910 (CH aliph), 1670 (C=O), 700 (C-S).	(DMSO-d_6) 3.70 (2H,s), 4.20 (2H,s), 7.00-8.00 (13H,m).
IIIc		165-167	72	$C_{22}H_{17}NOS$ (343.5) (ethanol)	3050 (CH arom), 2890 (CH aliph), 1670 (C=O), 700 (C-S).	(DMSO-d_6): 2.30 (3H,s), 3.70 (2H,s), 7.00-8.10 (12H,m).
IIId		130-140	73	$C_{21}H_{14}N_2O_3S$ (374.4) (ethanol)	3060 (CH arom), 2900 (CH aliph), 1675 (C=O), 1510 (NO_2), 700 (C-S).	(DMSO-d_6): 3.70 (2H,s), 7.00-8.20 (12H,m).
IIIe		150-152	70	$C_{21}H_{14}N_2OS$ (330.4) (ethanol)	3050 (CH arom), 2920 (CH aliph), 1675 (C=O), 700 (C-S).	(DMSO-d_6): 3.70 (2H,s), 7.00-8.20 (12H,m).
IVa		120-122	76	$C_{22}H_{17}NOS$ (343.5) (ethanol)	3060 (CH arom), 2890 (CH aliph), 1675 (C=O), 700 (C-S)	(DMSO-d_6): 3.60 (2H,s), 4.20 (2H,s), 7.00-8.20 (13H,m)

Contd.: Table (1).

IVb		190-192	80	$C_{23}H_{19}NOS$ (357.5) (ethanol)	3060 (CH arom), 2960 (CH aliph), 1670 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 3.80 (2H,s), 4.10 (2H,s), 7.00-8.10 (13H,m).
IVc		195-197	82	$C_{23}H_{19}NOS$ (357.5) (ethanol)	3050 (CH arom), 2920 (CH aliph), 1680 (C=O), 700 (C-S).	(DMSO-d_6): 2.3 (3H,s), 3.70 (2H,s), 4.20 (2H,s), 7.00-8.20 (12H, m).
IVd		170-172	70	$C_{22}H_{16}N_2O_3S$ (388.5) (ethanol)	3050 (CH arom), 2900 (CH aliph), 1670 (C=O), 1510 (NO_2), 700 (C-S).	(DMSO-d_6): 3.70 (2H,s), 4.20 (2H,s), 7.00-8.20 (12H,m).
IVe		110-112	75	$C_{21}H_{16}N_2OS$ (344.4) (ethanol)	3050 (CH arom), 2940 (CH aliph), 1670 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 4.20 (2H,s), 7.00-8.10 (12H,m).
Va	-OH	159-161°C	72	$C_{15}H_{11}NO_2S$ (269.3) (ethanol)	3500 (OH), 3050 (CH arom), 2950 (CH aliph), 1710 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 7.00-8.20 (8H,m), 10.10 (1H,s).
Vb	-OH	190-192	70	$C_{16}H_{13}NO_2S$ (283.4) (ethanol)	3500(OH), 3050 (CH arom), 2960 (CH aliph), 1710 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 4.20 (2H,s), 7.00-8.10 (8H,m), 10.00 (1H,s).
VIa	H	167-169	80	$C_{15}H_{12}N_2OS$ (268.3) (ethanol)	3400 (NH), 3060 (CH arom), 2920 (CH aliph), 1680 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 7.00-8.10 (8H,m), 9.50 (2H,d).
VIb		155-157	75	$C_{21}H_{16}N_2OS$ (344.4) (ethanol)	3400 (NH), 3050 (CH arom), 2940 (CH aliph), 1675 (C=O), 700 (C-S).	(DMSO-d_6): 3.70 (2H,s), 7.00-8.10 (13H,m), 9.50 (1H,s).
VIIa	H	195-197	82	$C_{16}H_{14}N_2OS$ (282.3) (ethanol)	3400 (NH), 3070 (CHarom), 2890 (CH aliph), 1675 (C=O), 700 (C-S).	(DMSO-d_6): 3.40 (2H,s), 4.10 (2H,s), 7.00-8.10 (8H,m), 10.00 (2H,d).
VIIb		220-222	70	$C_{22}H_{18}N_2OS$ (358.4) (ethanol)	3400 (NH), 3050 (CH arom), 2940 (CH aliph), 1675 (C=O), 700 (C-S).	(DMSO-d_6): 3.60 (2H,s), 4.20 (2H,s), 7.00-8.10 (13H,m), 9.50 (1H,s).

[a] All the synthesized compounds gave satisfactory elevential analyses.

Reaction of IIa and/or IIb with hydrazines and hydroxylamine hydrochloride gave the corresponding spirothiadiazinones (VIa,b), (VIIa,b), spiro[flourene-9,2`-thiazolidin]-3`-(hydroxyl)-4`-one (Va) and spiro[anthracene-9(10H)-2`-thiazolidin]-3`-(hydroxyl)-4`-one (Vb) respectively (cf. Table 1).

EXPERIMENTAL

The reactions were monitored by TLC. Melting points: openglass capillaries; uncorrected. IR spectra: Pye-Unicam SP 200 G. ^{1}H NMR spectra: EM 360 (90 MHz) spectrophotometer. Elemental analyses: Perkin-Elmer 240 C microanalyser.

Spiro[flourene-9,2`-(1`,3`-oxathiolan)]-5`-one (IIa) and spiro[anthracene-9(10H), 2`-(1`,3`-oxathiolan)]-5`-one (IIb): General procedure.

A mixture of flourenone and/or anthrone (o.1 mole), thioglycolic acid (0.1 mole), and catalytic amount of p-toluenesulfonic acid in 150 ml dry toluene was refluxed for 15 h. whereby the liberated water was removed by water separator. The reaction mixture was cooled to room temperature and toluene was removed under vac. and the product was precipitated.

Spiro[flourene-9,2`-thiazolidin]-3`-(aryl and/or heterocycles)-4`-one (IIIa-e) and spiro[anthracene-9(10H)-2`-thiazolidin]-3`-(aryl and/or heterocycles)-4`-one (IVa-e): General procedure.

A mixture of the spiro derivatives IIa and/or IIb (0.01 mole) and the primary aromatic (or heterocyclic) amine in absolute ethanol (100 ml) was stirred at reflux temperature for 2 h. The mixture was concentrated under vac. and the product was collected by filtration and crystallized from a proper solvent.

Spiro[flourene-9,2`-thiazolidin]-3`-(hydroxy)-4`-one (Va) and spiro[anthracene-9(10H)-2`-thiazolidin]-3`-(hydroxy)-4`-one (Vb): General procedure.

A mixture of IIa and/or IIb (0.001 mole) and hydroxylamine hydrochloride (0.001 mole) in ethanol/pyridine (50 ml, 1:1) was refluxed for 2 h. The mixture was cooled

and diluted with cold 5% aqueous hydrochloric acid whereby the desired products were precipitated and they were crystallized from the proper solvents.

Spiro[flourene-9,2`-thiadiazin]-3`-(hydro or phenyl)-4`-hydro-5`-one (VIa,b) and spiro[anthracene-9(10H)-2`-thiadiazin]-3`-(hydro or phenyl)-4`-hydro-5`-one (VIIa,b).

A mixture of the spiro derivatives IIa and/or IIb (0.001 mole) and hydrazine hydrate or phenylhydrazine (0.001 mole) in ethanol (50 ml) was refluxed for 3 h. The mixture was cooled to room temperature and concentrated under vac. and the product was collected by filtration and crystallized from a proper solvent.

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